

PLATING DEVICE

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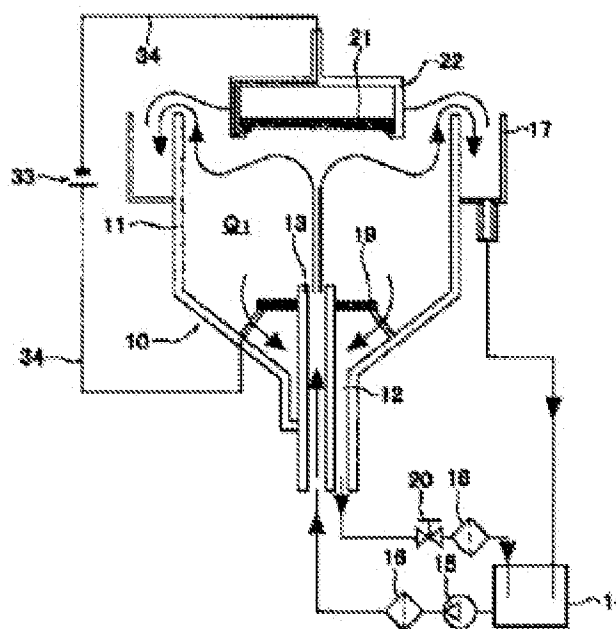
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Abstract of JP2001020096

PROBLEM TO BE SOLVED: To provide a plating device capable of forming a plated film having high quality by constructing into a face down system jet plating device and preventing the formation of a plated film on a cathode pin, the metal contamination on the rare surface or the side surface of a substrate to be plated and the leaving of bubbles on the plated surface. **SOLUTION:** The plating device has a ring like seal member in contact with the outer peripheral of a plating surface of the substrate 21 to be plated, possesses a substrate holder 22 to hold so as to expose the plating surface of the substrate and to turn the plating surface downward and performs the plating by forming a plating liquid jet flow reaching the plating surface of the substrate 21 from the under side of the substrate 21 to be plated, held by the substrate holder 22 in a plating vessel 11, in which the plating liquid Q1 is full filled. In such a case, a ventilation hole for releasing bubbles remaining on the surface of the substrate 21 to be plated to the outside of the substrate holder 22 is provided at the lower end part of the substrate holder 22.



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本発明に係るめっき装置の構成例

【特許請求の範囲】

【請求項1】 被めっき基板のめっきを施すめっき面外周に当接するリング状のシール部材を有し、該被めっき基板のめっき面を露出させ、且つ該めっき面を下に向けて保持する基板保持具を具備し、

めっき液の充填しためっき槽内で前記基板保持具に保持された被めっき基板の下方から該被めっき基板のめっき面に達するめっき液噴流を生成しながらめっきを行うめっき装置において、

前記基板保持具の下端部に被めっき基板のめっき面に残留する気泡を該基板保持具の外側に逃がす通気孔を設けたことを特徴とするめっき装置。

【請求項2】 請求項1に記載のめっき装置において、前記通気孔は前記基板保持具の被めっき基板のめっき面より下に位置する部分の内周面から外周面に貫通する孔であることを特徴とするめっき装置。

【請求項3】 請求項1に記載のめっき装置において、前記通気孔は前記基板保持具の被めっき基板のめっき面より下に位置する部分の内周面から前記めっき槽内のめっき液より上に位置する部分の外周面又は内周面に貫通する孔であることを特徴とするめっき装置。

【請求項4】 請求項1に記載のめっき装置において、前記通気孔は前記基板保持具の被めっき基板のめっき面より下に位置する部分の内周面から下面の外周部に貫通する孔であることを特徴とするめっき装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は被めっき基板のめっきを施すめっき装置に関し、特に半導体ウエハ等の表面に配線用の微細な溝や穴等が形成された被めっき基板に該溝や穴等を埋める金属めっきを施すのに好適なめっき装置に関するものである。

【0002】

【従来の技術】近年、半導体ウエハ等の表面に配線用の微細な溝や穴が形成された被めっき基板の該溝や穴等を埋めるために、銅めっき等の金属めっき装置を用い、金属めっきで該溝や穴等を埋める手法が採用されている。従来、この種のめっき装置として、フェースダウン方式の噴流めっき装置がある。図1は該フェースダウン方式の噴流めっき装置の構成を示す図である。

【0003】フェースダウン方式の噴流めっき装置100は、図1に示すように、めっき槽101を具備すると共に、該めっき槽101の上部に半導体ウエハ等の被めっき基板102をそのめっき面を下向きにして保持する基板保持具103を具備し、めっき液貯留槽104内のめっき液 Q_1 をポンプ105により、フィルタ106及びめっき液供給管107を通して、めっき槽101の底部から噴出させ、被めっき基板102のめっき面に垂直にめっき液の噴流を当てている。

【0004】めっき槽101をオーバーフローしためっ

き液 Q_1 はめっき槽101の外側に配置されためっき液受樋108で回収され、めっき液貯留槽104に戻るようになっている。めっき電源109より、陽極電極110と陰極電極（被めっき基板102のめっき面）の間に所定の電圧を印加することにより、該陽極電極110と被めっき基板102のめっき面との間にめっき電流が流れ、被めっき基板102のめっき面にめっき膜が形成される。

【0005】上記従来構成のフェースダウン方式の噴流めっき装置100は、めっき槽101の上部に配置した基板保持具103に支持ピンやカソードピンを設け、被めっき基板102をそのめっき面を下に向けて保持し、めっき槽101の上端と被めっき基板102の隙間からめっき液 Q_1 を流出させ、被めっき基板102にめっきを施している。

【0006】しかし、被めっき基板102のめっき面に給電するためのカソードピンはめっき液 Q_1 に触れるとカソードピン部にもめっき金属が析出し、被めっき基板を取り出す際にカソードピン近傍のめっき膜層を破壊する危険性がある。また、被めっき基板102が半導体ウエハであると、該半導体ウエハのめっき面に銅めっきを電解めっきする場合、銅はシリコン中に拡散しやすいため、半導体ウエハのめっき面にバリア層としてTiN、Ta₂N₅等を成膜し、該バリア層又はその上に薄く成膜された銅層を陰極として電解めっきを行うが、半導体ウエハの裏面や側面にはバリア層を形成していないため、この部分に銅を含むめっき液が付着することを防止しなければならない。

【0007】このため、被めっき基板をめっき液に浸漬させる浸漬めっきなどでは、被めっき基板102である半導体ウエハを基板保持具103により保持し、半導体ウエハの表面の外周部をシール部材でシールし、半導体ウエハの外周部と裏面がめっき液で濡らされることがないようにし、基板保持具103と半導体ウエハとシール部材で形成されためっき液に触れない空間において、カソードピンと半導体ウエハ裏面に接触させている。

【0008】上記のような基板保持具103をフェースダウン方式の噴流めっき装置に使用する場合、基板保持具103の周囲が被めっき基板102のめっき面より下に出っ張るため、基板保持具103に保持された被めっき基板をめっき液面に接触させただけでは、半導体ウエハ表面に空気層ができてしまい、正常なめっき膜を形成できないという問題があった。

【0009】

【発明が解決しようとする課題】本発明は、上述の点に鑑みてなされたもので、フェースダウン方式の噴流めっき装置であって、しかもカソードピンへめっき膜が形成されることなく、被めっき基板の裏面や側面の金属汚染がなく、めっき面に気泡を残さないことにより、品質のよいめっき膜が形成できるめっき装置を提供することを

目的とする。

【0010】

【課題を解決するための手段】上記課題を解決するため請求項1に記載の発明は、被めっき基板のめっきを施すめっき面外周に当接するリング状のシール部材を有し、該被めっき基板のめっき面を露出させ、且つ該めっき面を下に向けて保持する基板保持具を具備し、めっき液の充満しためっき槽内で基板保持具に保持された被めっき基板の下方から該被めっき基板のめっき面に達するめっき液噴流を生成しながらめっきを行うめっき装置において、基板保持具の下端部に被めっき基板のめっき面に残留する気泡を該基板保持具の外側に逃がす通気孔を設けたことを特徴とする。

【0011】被めっき基板のめっき面に残留する気泡を少なくするために、基板保持具の外周部の被めっき基板より下に位置する部分はできるだけ薄くすることが望ましいが、被めっき基板とシール部材を密着させ、被めっき基板とカソードピンを密着させるため、被めっき基板の裏面から押え板により抑えつける必要があり、この押え付け力を受けるために基板保持具の外周部の被めっき基板のめっき面より下に位置する部分を数mm以下に減少させることが難しい。このため、この部分に上記のように通気孔を設けることにより、基板保持具の下部外周部と被めっき基板のめっき面で囲まれた空間に残留する気泡はこの通気孔を通して外部に抜ける。

【0012】但し、基板保持具の外周部の被めっき基板のめっき面より下に位置する部分にはシール部材やカソードピンがあるため、通気孔を被めっき基板のめっき面と同じ高さに設けることはできない。従って、被めっき基板のめっき面の残留気泡を完全に除くことができないので、基板保持具及びウエハを回転させることにより、被めっき基板の中心から外部に向かう流れを強化し、この流れによって被めっき基板のめっき面に残留する気泡を流すことができる。

【0013】請求項2に記載の発明は、請求項1に記載のめっき装置において、通気孔は基板保持具の被めっき基板のめっき面より下に位置する部分の内周面から外周面に貫通する孔であることを特徴とする。

【0014】請求項3に記載の発明は、請求項1に記載のめっき装置において、通気孔は基板保持具の被めっき基板のめっき面より下に位置する部分の内周面からめっき槽内のめっき液より上に位置する部分の外周面又は内周面に貫通する孔であることを特徴とする。

【0015】上記のように、通気孔を被めっき基板のめっき面より下に位置する部分の内周面からめっき液面より上に位置する部分の外周面又は内周面に貫通する孔とすることにより、被めっき基板のめっき面に残留する気泡は該通気孔を通して抜けやすくなる。

【0016】請求項4に記載の発明は、請求項1に記載のめっき装置において、通気孔は基板保持具の被めっき

基板のめっき面より下に位置する部分の内周面から下面の外周部に貫通する孔であることを特徴とする。

【0017】上記のように、通気孔は基板保持具の被めっき基板のめっき面より下に位置する部分の内周面から下面の外周部に貫通する孔とすることにより、基板保持具の下側の流速が大きく静圧が低い時、基板保持具の下面外周部の内側との静圧差により被めっき基板のめっき面に残留する気泡は該通気孔を通して抜ける。

【0018】

【発明の実施の形態】以下、本発明の実施の形態例を図面に基いて説明する。図2は本発明に係るめっき装置の構成例を示す図である。本めっき装置10はめっき槽11を具備する。該めっき槽11は略円筒形断面で、底部は中央が低いテーパ状になっており、最も低い中央点の周囲にめっき液 Q_1 をめっき槽11の外部に流出させるための流出孔12が設けられている。めっき槽11の中央部にはめっき液 Q_1 を上方に向けて噴出するめっき液噴出管13がめっき槽11の内部にまで突き出ている。

【0019】ポンプ15により、めっき液貯留槽14からフィルタ16を通してめっき液噴出管13から噴射されためっき液 Q_1 は、めっき槽11の上縁部からオーバーフローし、めっき槽11の外側に設けためっき液受樋17で回収され、該めっき液受樋17からめっき液貯留槽14に流入する。また、めっき液噴出管13から噴出されためっき液 Q_1 の一部は、流出孔12を通してめっき槽11の外部に流出し、フィルタ又はセパレータ18によってブラックフィルムの剥離片や陽極電極板19への付着物、堆積物を除去した後、めっき液貯留槽14に流入する。図2では流出孔12からめっき液貯留槽14の間はめっき液 Q_1 の重力によって流下させているが、流出孔12からフィルタ又はセパレータ18の間にポンプを設けてもよい。なお、20は流量調整バルブである。

【0020】めっき槽11のめっき液 Q_1 中の下部には陽極電極板19を該めっき槽11の中心軸に直角に配設する。この陽極電極板19には溶解性の電極板を用い、銅めっきの場合には含リン銅を用いる。図2では陽極電極板19は円板状で中央に開口が形成され、めっき液噴出管13をその開口内部を通して配置し、該陽極電極板19の周囲を流れるめっき液流れを該陽極電極板19の下方にある流出孔12を通してめっき槽11の外部に流しているが、図3に示すように、陽極電極板19に複数の貫通孔を設け、該貫通孔を通っためっき液 Q_1 を流出孔12からめっき槽11の外部に流出させてもよい。なお、図3のめっき装置ではめっき液噴出管13はめっき槽11の下部外周部から、上部中央に向けてめっき液を噴出させている。

【0021】また、図4に示すように、陽極電極板19を貫通しためっき液を集合部から流出孔12を通してめ

つき槽11の外部に流出させることも可能である。陽極電極板19は被めつき基板21のめつき面と略同じ程度の大きさがあれば、被めつき基板21に対向した平面とするが、陽極電極板19が被めつき基板21のめつき面に比べて大幅に小さく、且つ被めつき基板21のめつき面と陽極電極板19の間隔が小さい場合には、図3に示すように球面状とすることがよい。

【0022】被めつき基板21が半導体ウエハである場合において、被めつき基板21を保持する基板保持具22について図5及び図6に基づいて説明する。半導体ウエハの表面に銅を電解めつきする場合、銅は上記のようにシリコン中へ拡散しやすいため、半導体ウエハのめつき面にバリア層として、Ti、Ta、TiN、Ta₂N等の金属又はその化合物を成膜し、該バリア層又はその上に薄く成膜された銅層を陰極として電解めつきを行う。

【0023】被めつき基板21のめつき面に給電するためのカソード電極ピン29はめつき液Q₁に触れると該カソード電極ピン29にもめつき金属が析出し、被めつき基板21を基板保持具22から取り出す際カソード電極ピン29の近傍のめつき膜を破壊する危険性が高い。そのため図5に示すように、被めつき基板21を基板保持具22に保持させ、被めつき基板21の表面外周部にめつき液Q₁が浸入しないようにシール部材23でシールし、カソード電極ピン29を基板保持具22と被めつき基板21とシール部材23で形成されためつき液Q₁に触れない空間において、被めつき基板21の表面に接触させている。

【0024】基板保持具22は、内部に被めつき基板21を収容できる基板保持ケース24を具備している。該基板保持ケース24は被めつき基板の径よりやや大きい径の円筒状で、その下端面は被めつき基板21より若干小さい径の開口が形成され、上端面は閉じられた構造である。そして該基板保持ケース24の上面の中央に回転軸25が取り付けられ、側面には被めつき基板21を出し入れするためのスリット状の基板出入開口26が形成されている。また、基板保持ケース24は絶縁材からなり、その内部には被めつき基板21の径と略同じ径の円板状の基板押え板27を具備している。

【0025】基板押え板27は絶縁材からなり、その上面の中央には該基板押え板27を上下動させる上下動軸28が取り付けられている。該上下動軸28は基板保持ケース24の上面に取り付けた回転軸25の中央部を貫通して上方に伸びている。基板保持ケース24の下面の開口の周囲には、リング状のシール部材23が設けられ、該シール部材23は被めつき基板21の表面(下面)に密着することにより、めつき液が基板保持ケース24内に浸入し、被めつき基板21の裏面及び外周面にめつき液が触れないようにしている。このシール部材23の外側で且つ基板保持ケース24の下面内側に複数又はリング状のカソード電極ピン29が設けられ、該カソ

ード電極ピン29が被めつき基板21の表面外周部に当接するようになっている。

【0026】被めつき基板21のめつき面の電位を均一にするためには、カソード電極ピン29は被めつき基板21の表面外周の全域に接触するようにピンを密に並べた形状又は被めつき基板21と線接触するようにリング状板で構成し、内周部を被めつき基板21側に折り曲げ弾性を持たせた構造とすることが好ましい。被めつき基板21をそのめつき面を下にして、裏面をロボットハンド30で吸着保持して、基板保持ケース24のスリット状の基板出入開口26を通して内部に移動された被めつき基板は上記シール部材23及びカソード電極ピン29に当接する。

【0027】基板保持具22は回転軸25に支持され、上下駆動機構(図示せず)により上部位置と下部位置の間を上下動するようになっている。そして上部位置では基板保持ケース24と内部に保持された被めつき基板21がめつき液に触れない位置まで上昇しており、この位置でめつき液の被めつき基板21を取り出し、未処理の被めつき基板21を基板保持ケース24の内部に搭載するようになっている。また、基板保持具22が下部位置にある時は、被めつき基板21のめつき面はめつき液内に浸漬される。

【0028】被めつき基板の取り出しは、基板保持具22をめつき液に触れない上記上部位置まで上昇させ、図6に示すように、基板押え板27を上昇させた後、基板保持ケース24の基板出入開口26からロボットハンド30を挿入し、被めつき基板21の裏面を真空吸着して持ち上げ、被めつき基板21を基板出入開口26のスリット状部分26aを通過させて取り出す。この為、基板出入開口26の中央部26bはロボットハンド30が通過するように大きく開口している。

【0029】被めつき基板21を基板保持ケース24内に挿入させ、保持させるには上記被めつき基板21の取り出しと逆の動作で行う。この場合、基板保持ケース24内で被めつき基板21が所定の位置に配置されるように、基板保持ケース24の下部内径は被めつき基板21の外径と略同じで若干大きくしている。

【0030】めつき槽11の下方からめつき液を噴流させながらめつきを行う噴流めつきでは、被めつき基板21のめつき面を下にして、被めつき基板21はめつき槽11の上端より上に位置し、噴流によって盛り上がっためつき液面にめつき面を接触させる方法が一般的である。しかし、本発明の実施の形態例ではシール部材23によって被めつき基板21のめつき面以外をめつき液Q₁に接触させない基板保持具22を用いているため、基板保持具22と該基板保持具22に保持させた被めつき基板21をめつき液Q₁に浸漬させてめつきを行うことができる。

【0031】これにより被めつき基板21のめつき面と

陽極電極板19との距離を自由に調整することができる。また、被めっき基板21を基板保持具22に保持させたままめっき槽11の外部に移動し、被めっき基板21及び基板保持具22を水洗浄することも可能である。

【0032】めっき槽11内部のめっき液 Q_1 の流れや陽極電極板19と被めっき基板21のめっき面との間の電界などは円周方向に必ずしも一様にならないため、めっきの均一性を向上させるため、被めっき基板21をめっき槽11内で回転させることが有効である。このため、基板保持具22の基板保持ケース24に取り付けた回転軸25を回転させる回転駆動機構(図示せず)を設ける。この回転は、めっき時だけでなく、被めっき基板21を基板保持具22に装着後、めっき液 Q_1 に接触させる際の気泡除去、電解めっき終了後に基板保持具22及び被めっき基板21をめっき液面上に上昇させた後、回転させることによりめっき液切りにも有効である。

【0033】回転に限らず、被めっき基板21のめっき面とめっき液 Q_1 の相対速度を増加する目的は、被めっき基板21のめっき面近傍の濃度拡散層を薄くすることであり、薄くすることによりイオン供給量によりめっき速度が制限されるということが防止され、全面均一なめっき被膜が形成され、更に電流密度が大きく高速めっきが可能になる。

【0034】図2に示す構成のめっき装置では、被めっき基板21を回転させる為、基板保持具22の上方に延びた回転軸25の上部をモータ等の回転駆動機構に連結し、被めっき基板21を水平面内で回転できるようにしている。めっき中の回転は10~300rpmの低速回転であるが、めっき終了後基板保持具22及び被めっき基板21がめっき液 Q_1 に接触しない位置まで上昇させてめっき液切りを行うには500rpm以上の回転(望ましくは1000rpm以上の回転)が必要になる。このため、回転駆動機構にはこれに合った制御機構が必要である。

【0035】また、図2に示す構成のめっき装置では、上記回転以外に、基板保持具22の昇降のための保持具上下駆動機構、基板押え板27の昇降のための押え板上下駆動機構(いずれも図示せず)を設けた。押え板上下駆動機構は下方向にはバネ力、上方向にはエアによって駆動するエアシリンダで、回転駆動機構によって支えられた枠内に収容され、エア配管はモータ中央を貫通してモータ上部でロータリージョイントにより外部に接続される。モータ及び押え板駆動機構は保持具上下駆動機構によって支えられた枠内に収容され、保持具上下駆動機構によって昇降される。

【0036】被めっき基板21を基板保持具22に装着後、めっき槽11内のめっき液噴出管13からのめっき液 Q_1 の噴射を開始し、基板保持具22を50~300rpmで回転させながら、中央の盛り上がっためっき液面に被めっき基板21が接触するまで基板保持具22を

降下させ、めっき液面中央が被めっき基板21に接触した状態から更にゆっくり基板保持具22を降下させる。こうすることにより、被めっき基板21の下面にめっき液 Q_1 が充填され、被めっき基板21と基板保持具22の基板保持ケース24の下部との空間から空気が排出される。

【0037】この空気の排出を効率よく行うため、図7に示すように、基板保持ケース24の下部で被めっき基板21を押えている外周部の被めっき基板21の下面より下に位置する部分の内側から外側に貫通する通気孔31を複数設けている。これにより、被めっき基板をめっき槽11に入れた時、基板保持具22の基板保持ケース24の下端外周部と被めっき基板21によって形成された凹部にできる空気溜りの高さが、被めっき基板21の下面から通気孔31の開口上端までの高さに低減され、基板保持具22がめっきを行う所定の位置に設置された後であっても、基板保持具22の回転によって被めっき基板21と基板保持ケース24の下部とによって形成された空間から空気を容易に排出することができる。

【0038】図8は被めっき基板21と基板保持ケース24の下部との空間から空気を排出する上記通気孔31の他の配置例を示す図である。図示するように、通気孔31は基板保持ケース24の被めっき基板21の下面より下に位置する部分の内側から被めっき基板21より上に位置する部分の外側に貫通している。この通気孔31が外側に開口する位置は、めっきを行う時のめっき槽11内のめっき液面より上の位置となるようにする。このように、通気孔31がめっき液面より上の基板保持ケース24の外側で開口することにより、被めっき基板21と基板保持ケース24の下部とによって形成された空間から空気を容易に排出することができる。なお、上記通気孔31の開口はめっき液面より上であれば、基板保持ケース24の上面又は内面に開口してもよい。

【0039】図9は被めっき基板21と基板保持ケース24の下部との空間から空気を排出する上記通気孔31の他の配置例を示す図である。図示するように、通気孔31は基板保持ケース24の被めっき基板21の下面より下に位置する部分の内側から下面の外周部に貫通している。通気孔31を上記のように配置することにより、図10に示す構成のめっき装置のように、基板保持具22の外周部の直下に、被めっき基板21のめっき面より大きな仕切板32が設けられた場合は、基板保持具22の外周部の下側でめっき液 Q_1 の流速が上昇し、静圧が低下するから、この静圧の低下を利用して、被めっき基板21の下面に捕えられた空気を外部に排出させることができる。

【0040】めっきを行う際は、めっき電源33から配線34、カソード電極ピン29を通して、陽極電極板19と被めっき基板21の間に所定の電圧を印加して行う。

【0041】なお、上記本発明の実施の形態例では、被めっき基板21に半導体ウエハを用いる例を説明したが、本発明のめっき装置でめっきの対象とする被めっき基板21は半導体ウエハに限定されるものではなく、表面に微細な溝や穴等が形成された基板の該溝や穴等を埋める金属めっきを施すのに広く利用できることは当然であり、表面に微細な溝や穴等が形成されていない基板の表面めっきにも利用できる。

【0042】

【発明の効果】以上説明したように、各請求項に記載の発明によれば、被めっき基板のめっき面以外にめっき液が触れないように、シール部材でシールし、下方からめっき面に達するめっき液噴流を生成しながらめっきを行うめっき装置において、基板保持具の下端部に被めっき基板のめっき面に残留する気泡を基板保持具の外側に逃がす通気孔を設けたので、カソードピンにめっき膜が形成されることなく、被めっき基板の裏面や側面の金属汚染がなく、めっき面に気泡が残らないことにより、めっき膜の均一性に優れ、シミの無い、高品質のめっきができるめっき装置を提供できるという優れた効果が得られる。

【0043】請求項3に記載の発明によれば、請求項1に記載のめっき装置において、通気孔は基板保持具の被めっき基板のめっき面より下に位置する部分の内周面からめっき槽内のめっき液より上に位置する部分の外周面又は内周面に貫通する孔とするので、上記効果に加え被めっき基板のめっき面に残留する気泡は該通気孔を通過して抜けやすくなる。

【0044】請求項4に記載の発明によれば、請求項1に記載のめっき装置において、通気孔は基板保持具の被めっき基板のめっき面より下に位置する部分の内周面から下面の外周部に貫通する孔とするので、上記効果に加え基板保持具の下側の流速が大きく静圧が低い時、基板保持具の下面外周部の内側との静圧差により被めっき基板のめっき面に残留する気泡は該通気孔を通過して抜ける。

【図面の簡単な説明】

【図1】従来のフェースダウン方式の噴流めっき装置の構成を示す図である。

【図2】本発明に係るめっき装置の構成例を示す図である。

【図3】本発明に係るめっき装置の構成例を示す図である。

【図4】本発明に係るめっき装置の構成例を示す図である。

【図5】本発明に係るめっき装置の基板保持具の構成を示す図である。

【図6】本発明に係るめっき装置の基板保持具の動作を説明するための図である。

【図7】本発明に係るめっき装置の基板保持具下部の通気孔の配置例を示す図である。

【図8】本発明に係るめっき装置の基板保持具下部の通気孔の配置例を示す図である。

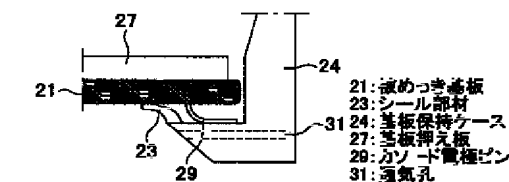
【図9】本発明に係るめっき装置の基板保持具下部の通気孔の配置例を示す図である。

【図10】本発明に係るめっき装置の構成例を示す図である。

【符号の説明】

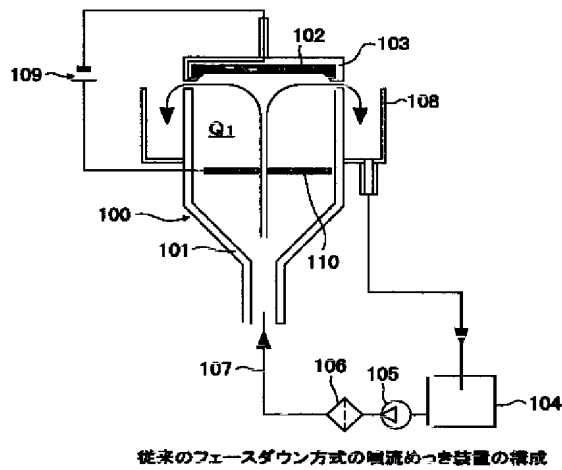
10	めっき装置
11	めっき槽
12	流出孔
13	めっき液噴出管
14	めっき液貯留槽
15	ポンプ
16	フィルタ
17	めっき液受樋
18	フィルタ又はセパレータ
19	陽極電極板
20	流量調整バルブ
21	被めっき基板
22	基板保持具
23	シール部材
24	基板保持ケース
25	回転軸
26	基板出入開口
27	基板押え板
28	上下動軸
29	カソード電極ピン
30	ロボットハンド
31	通気孔
32	仕切板

【図7】

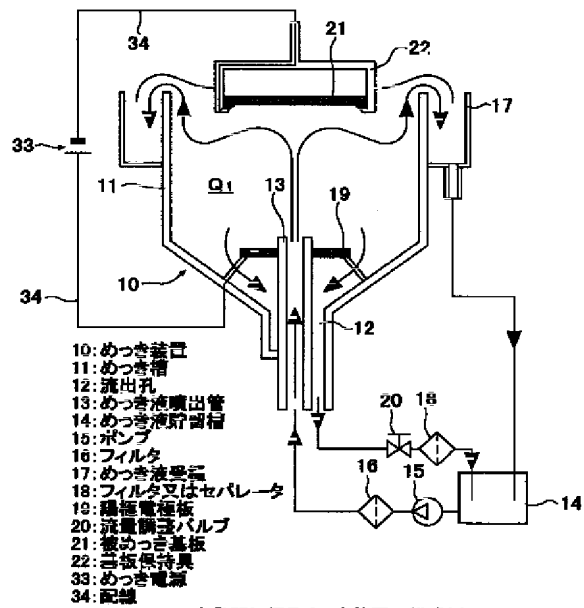


本発明に係るめっき装置の基板保持具下部の通気孔の配置例

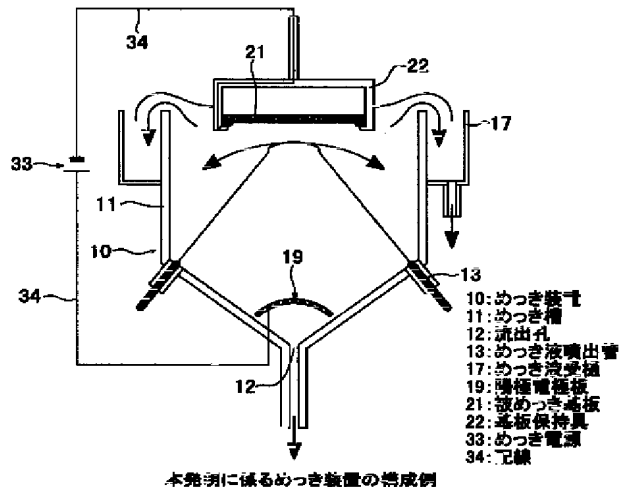
【図1】



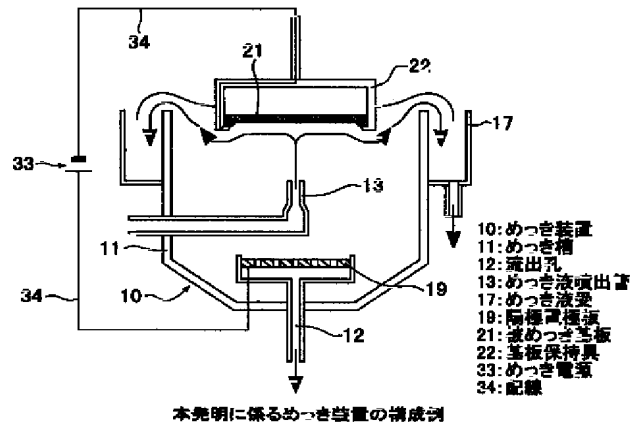
【図2】



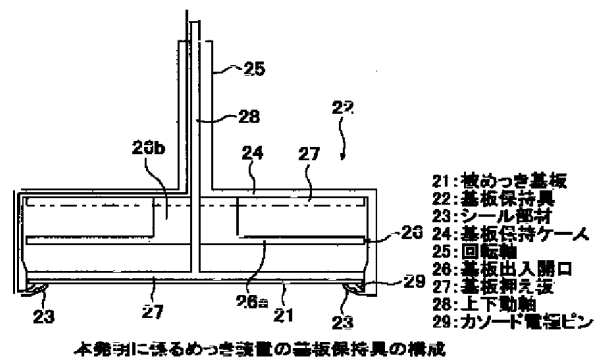
【図3】



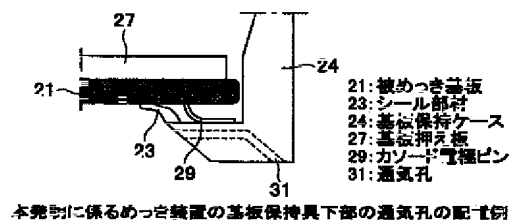
【図4】



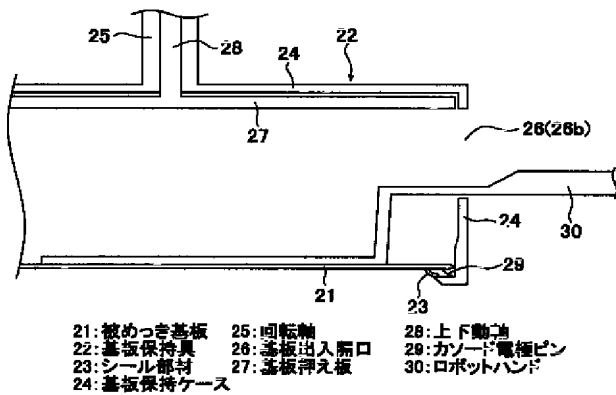
【図5】



【図9】

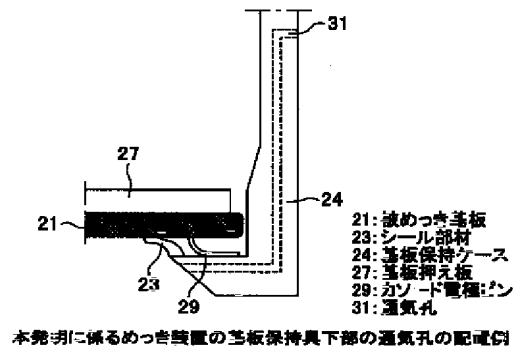


【図6】



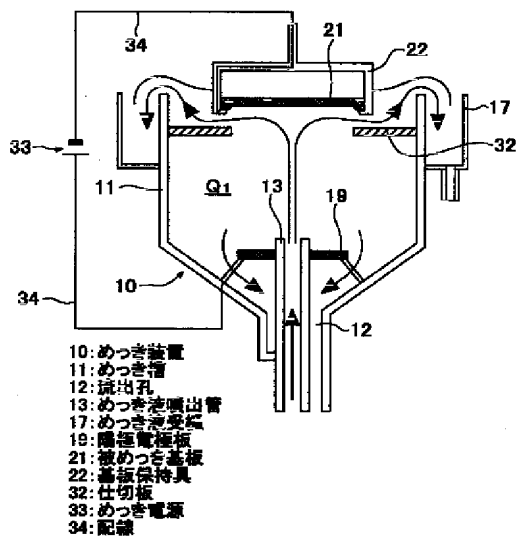
本発明に係るめっき装置の基板保持具の動作

【図8】



本発明に係るめっき装置の基板保持具下部の通気孔の配成例

【図10】



本発明に係るめっき装置の構成例

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TECHNICAL FIELD

[Field of the Invention]This invention relates to a suitable plating device to perform metal plating with which this slot, a hole, etc. are filled up to the substrate with which a detailed slot, a hole, etc. for wiring were formed especially in the surfaces, such as a semiconductor wafer, to be plated about the plating device which plates a substrate to be plated.

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PRIOR ART

[Description of the Prior Art]In recent years, in order to fill this slot, a hole, etc. of a substrate to be plated where the detailed slot and hole for wiring were formed in the surfaces, such as a semiconductor wafer, metal plating devices, such as copper plating, are used and the technique of filling this slot, a hole, etc. by metal plating is adopted. Conventionally, there is a jet plating device of a facedown method as this kind of a plating device. Drawing 1 is a figure showing the composition of the jet plating device of this facedown method.

[0003]The jet plating device 100 of a facedown method, As shown in drawing 1, provide the plating tub 101, and the board holder 103 which makes the substrates 102, such as a semiconductor wafer, to be plated the upper part of this plating tub 101, places the plating side upside down, and is held is provided, With the pump 105, let the filter 106 and the plating liquid feed pipe 107 pass, plating liquid Q_1 in the plating liquid depot 104 was made to blow off from the pars basilaris ossis occipitalis of the plating tub 101, and the jet of plating liquid is applied at right angles to the plating side of the substrate 102 to be plated.

[0004]Plating liquid Q_1 which overflowed the plating tub 101 is collected in the plating liquid receiving chute 108 arranged at the outside of the plating tub 101, and returns to the plating liquid depot 104. From the plating power supply 109, by impressing predetermined voltage between the anode electrode 110 and a cathode electrode (plating side of the substrate 102 to be plated), a plating current flows between this anode electrode 110 and the plating side of the substrate 102 to be plated, and a plating film is formed in the plating side of the substrate 102 to be plated.

[0005]Conventionally [above-mentioned] the jet plating device 100 of the facedown method of composition, A holding pin and cathode pins are provided in the board holder 103 arranged in the upper part of the plating tub 101, Turned the substrate 102 to be plated downward, held the plating side for it, plating liquid Q_1 was made to flow out of the upper bed of the plating tub 101, and the crevice between the substrates 102 to be plated, and it has plated to the substrate 102 to be plated.

[0006]However, if the cathode pins for supplying electric power to the plating side of the substrate 102 to be plated touch plating liquid Q_1 , when plating metal will deposit also in a cathode-pins part and they will take out a substrate to be plated, they have the danger of destroying the plating membrane layer near the cathode pins. Since it is easy to diffuse copper in silicon when carrying out electrolysis plating of the copper plating to the substrate 102 to be plated being a semiconductor wafer in the plating side of this semiconductor wafer, Although electrolysis plating is performed by using as the negative pole the copper layer which formed TiN, TaN, etc. as a barrier layer to the plating side of the semiconductor wafer, and was thinly formed this barrier layer or on it, Since the barrier layer is not formed in the rear face or the side of a semiconductor wafer, the plating liquid containing copper must be prevented from adhering to this

portion.

[0007]For this reason, by immersion plating which plating liquid is made to immerse, a substrate to be plated. The semiconductor wafer which is the substrate 102 to be plated is held with the board holder 103, Carry out the seal of the peripheral part of the surface of a semiconductor wafer by a sealing member, and the peripheral part and rear face of a semiconductor wafer are made not to be soaked in plating liquid, In the space which cannot touch the board holder 103, a semiconductor wafer, and the plating liquid formed by the sealing member, the semiconductor wafer rear face is contacted to cathode pins.

[0008]Since the circumference of the board holder 103 protrudes below the plating side of the substrate 102 to be plated when using the above board holders 103 for the jet plating device of a facedown method, Only by contacting the substrate held at the board holder 103 to be plated on a plating oil level, the air layer was made on the semiconductor wafer surface, and there was a problem that a normal plating film could not be formed.

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EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, by the invention of a statement, to each claim. In the plating device which plates while generating the plating liquid jet which carries out a seal by a sealing member and reaches a plating side from a lower part so that plating liquid cannot be touched other than the plating side of a substrate to be plated, The vent which misses the air bubbles which remain to the plating side of a substrate to be plated at the lower end part of a board holder on the outside of a board holder was provided.

Therefore, without forming a plating film in cathode pins, when there is no metallic contamination of the rear face of a substrate to be plated or the side and air bubbles do not remain in a plating side, the outstanding effect that the plating device which is excellent in the homogeneity of a plating film and does not have silverfish and which can perform quality plating can be provided is acquired.

[0043]In [according to the invention according to claim 3] the plating device according to claim 1, Since a vent is used as the hole penetrated to the peripheral face or inner skin of a portion located above the plating liquid in a plating tub from the inner skin of the portion located below the plating side of the substrate of a board holder to be plated, it becomes easy to escape from the air bubbles which remain to the plating side of a substrate to be plated in addition to the above-mentioned effect through this vent.

[0044]Since a vent is used as the hole penetrated to a peripheral part at the bottom from the inner skin of the portion located below the plating side of the substrate of a board holder to be plated in the plating device according to claim 1 according to the invention according to claim 4, In addition to the above-mentioned effect, when [when the rate of flow of the board holder bottom is large] a static pressure is low, it escapes from the air bubbles which remain to the plating side of a substrate to be plated according to the static pressure difference inside the undersurface peripheral part of a board holder through this vent.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]This invention was made in view of the above-mentioned point, and is a jet plating device of a facedown method. The purpose is to provide the plating device which can form a quality plating film by there being no metallic contamination of the rear face of a substrate to be plated or the side, and not leaving air bubbles to a plating side, without moreover forming a plating film in cathode pins.

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MEANS

[Means for Solving the Problem]In order to solve an aforementioned problem the invention according to claim 1, It has a sealing member of ring shape which contacts a plating side periphery which plates a substrate to be plated, Expose a plating side of this substrate to be plated, and a board holder which turns this plating side downward and holds it is provided, In a plating device which plates while generating a plating liquid jet which reaches a plating side of this substrate to be plated from a lower part of a substrate held at a board holder within a plating tub with which plating liquid was filled to be plated, A vent which misses air bubbles which remain to a plating side of a substrate to be plated at a lower end part of a board holder on the outside of this board holder was provided.

[0011]As for a portion located below a substrate of a peripheral part of a board holder to be plated, in order to lessen air bubbles which remain in a plating side of a substrate to be plated, it is desirable to make it as thin as possible, but. In order to stick a substrate to be plated and a sealing member and to stick a substrate to be plated and cathode pins, In order to stop with a pressure plate from a rear face of a substrate to be plated and to receive this pressing-down power, it is difficult to decrease a portion located below a plating side of a substrate of a peripheral part of a board holder to be plated to several millimeters or less. For this reason, it escapes from air bubbles which remain to space surrounded in respect of plating of a lower peripheral part of a board holder, and a substrate to be plated outside through this vent by providing a vent in this portion as mentioned above.

[0012]However, since a sealing member and cathode pins are among portions located below a plating side of a substrate of a peripheral part of a board holder to be plated, a vent cannot be provided in the same height as a plating side of a substrate to be plated. Therefore, since remains air bubbles of a plating side of a substrate to be plated cannot be removed thoroughly, by rotating a board holder and a wafer, a flow which goes outside from the center of a substrate to be plated can be strengthened, and air bubbles which remain to a plating side of a substrate to be plated by this flow can be poured.

[0013]The invention according to claim 2 is characterized by a vent being a hole penetrated to a peripheral face from inner skin of a portion located below a plating side of a substrate of a board holder to be plated in the plating device according to claim 1.

[0014]The invention according to claim 3 is characterized by a vent being a hole penetrated to a peripheral face or inner skin of a portion located above plating liquid in a plating tub from inner skin of a portion located below a plating side of a substrate of a board holder to be plated in the plating device according to claim 1.

[0015]As mentioned above, it becomes easy to escape by using a vent as a hole penetrated to a peripheral face or inner skin of a portion located above a plating oil level from inner skin of a portion located below a plating side of a substrate to be plated from air bubbles which remain to a plating side of a substrate to be plated through this vent.

[0016]The invention according to claim 4 is characterized by a vent being a hole penetrated to a peripheral part at the bottom from inner skin of a portion located below a plating side of a substrate of a board holder to be plated in the plating device according to claim 1.

[0017]As mentioned above, by using a vent as a hole penetrated to a peripheral part at the bottom from inner skin of a portion located below a plating side of a substrate of a board holder to be plated, When [when the rate of flow of the board holder bottom is large] a static pressure is low, it escapes from air bubbles which remain to a plating side of a substrate to be plated according to a static pressure difference inside an undersurface peripheral part of a board holder through this vent.

[0018]

[Embodiment of the Invention]the following and an embodiment of the invention — an example is explained based on a drawing. Drawing 2 is a figure showing the example of composition of the plating device concerning this invention. This plating device 10 possesses the plating tub 11. This plating tub 11 is a cylindrical shape section, the pars basilaris ossis occipitalis is tapered shape with a low center, and the discharge hole 12 for making plating liquid Q_1 flow into the circumference of the lowest center point to the exterior of the plating tub 11 is formed. The plating liquid jet pipe 13 which turns plating liquid Q_1 to the center section of the plating tub 11 up, and is spouted has projected even inside the plating tub 11.

[0019]With the pump 15, plating liquid Q_1 injected from the plating liquid jet pipe 13 through the filter 16 from the plating liquid depot 14, It overflows from the rising wood of the plating tub 11, is collected in the plating liquid receiving chute 17 established in the outside of the plating tub 11, and flows into the plating liquid depot 14 from this plating liquid receiving chute 17. A part of plating liquid Q_1 which blew off from the plating liquid jet pipe 13. After it flows into the exterior of the plating tub 11 through the discharge hole 12 and a filter or the separator 18 removes the affix to the peeling piece and the positive electrode plate 19 of a black film, and a sediment, it flows into the plating liquid depot 14. Although it is made to flow down with the gravity of plating liquid Q_1 between the plating liquid depots 14 from the discharge hole 12 in drawing 2, a pump may be formed between a filter or the separator 18 from the discharge hole 12. 20 is a flow control valve.

[0020]The positive electrode plate 19 is allocated in the lower part in plating liquid Q_1 of the plating tub 11 right-angled at the medial axis of this plating tub 11. In the case of copper plating, phosphorus-containing copper is used at this positive electrode plate 19 using a soluble electrode plate. Although an opening is formed in the center by disc-like, the positive electrode plate 19 arranges the plating liquid jet pipe 13 through the inside of an opening and the plating liquid flow which flows through the circumference of this positive electrode plate 19 is passed to the exterior of the plating tub 11 through the discharge hole 12 which has this positive electrode plate 19 caudad in drawing 2. Two or more breakthroughs may be provided in the positive electrode plate 19, and plating liquid Q_1 which passed along this breakthrough may be made to flow out of the discharge hole 12 into the exterior of the plating tub 11, as shown in drawing 3. The plating liquid jet pipe 13 is making plating liquid blow off from the lower peripheral part of the plating tub 11 towards an upper center with the plating device of drawing 3.

[0021]As shown in drawing 4, it is also possible to make the plating liquid which penetrated the positive electrode plate 19 flow out of a collective part into the exterior of the plating tub 11 through the discharge hole 12. the positive electrode plate 19 — the plating side of the substrate 21 to be plated — abbreviated — it being considered as the flat surface which countered the substrate 21 to be plated, if there is a size of the same grade, but. It is good to consider it as sphere form, as the positive electrode plate 19 shows drawing 3 substantially small, when the plating side of the substrate 21 to be plated and the interval of the positive electrode plate 19

are small compared with the plating side of the substrate 21 to be plated.

[0022]When the substrate 21 to be plated is a semiconductor wafer, the board holder 22 holding the substrate 21 to be plated is explained based on drawing 5 and drawing 6. Since it is easy to diffuse copper into silicon as mentioned above when carrying out electrolysis plating of the copper on the surface of a semiconductor wafer, Electrolysis plating is performed by using as the negative pole the copper layer which formed metal, such as Ti, Ta, TiN, and TaN, or the compound of those to the plating side of the semiconductor wafer, and was thinly formed as a barrier layer in it at this barrier layer or on its top.

[0023]If the cathode electrode pin 29 for supplying electric power to the plating side of the substrate 21 to be plated touches plating liquid Q_1 , when plating metal will deposit also in this cathode electrode pin 29 and it will pick out the substrate 21 to be plated from the board holder 22, its danger of destroying the plating film near the cathode electrode pin 29 is high. Therefore, the substrate 21 to be plated is made to hold to the board holder 22, as shown in drawing 5, A seal is carried out by the sealing member 23 so that plating liquid Q_1 may not infiltrate into the surface peripheral part of the substrate 21 to be plated, In the space which cannot touch plating liquid Q_1 formed by the board holder 22, the substrate 21 to be plated, and the sealing member

23, the cathode electrode pin 29 is contacted on the surface of the substrate 21 to be plated. [0024]The board holder 22 possesses the board holding case 24 which can accommodate the substrate 21 to be plated in an inside. This board holding case 24 is the cylindrical shape of a little larger path than the path of a substrate to be plated, the opening of the path in which the lower end surface is a little smaller than the substrate 21 to be plated is formed, and an upper bed side is the closed structure. And the axis of rotation 25 is attached in the center of the upper surface of this board holding case 24, and the slit shape substrate in-and-out opening 26 for taking the substrate 21 to be plated in and out is formed in the side. moreover — the board holding case 24 consists of insulation materials — the inside — the path of the substrate 21 to be plated — abbreviated — the disc-like substrate-presser-foot board 27 of the same path is provided.

[0025]The substrate-presser-foot board 27 consists of insulation materials, and the moving shaft 28 which moves this substrate-presser-foot board 27 up and down is attached in the center of the upper surface. This moving shaft 28 penetrated the center section of the axis of rotation 25 attached to the upper surface of the board holding case 24, and is extended up. Around the opening of the undersurface of the board holding case 24, The sealing member 23 of ring shape is formed, plating liquid permeates into the board holding case 24, and this sealing member 23 is prevented from touching plating liquid by sticking to the surface (undersurface) of the substrate 21 to be plated in the rear face and peripheral face of the substrate 21 to be plated. It is the outside of this sealing member 23, and plurality of the cathode electrode pin 29 of ring shape is formed inside [undersurface] the board holding case 24, and this cathode electrode pin 29 contacts the surface peripheral part of the substrate 21 to be plated.

[0026]In order to make uniform potential of the plating side of the substrate 21 to be plated, As for the cathode electrode pin 29, it is preferred to consider it as the structure which consisted of ring shape boards so that it might contact throughout the surface periphery of the substrate 21 to be plated, and line contact of the pin might be carried out to the shape or the substrate 21 to be plated put in order densely, bent the inner periphery to the substrate [to be plated] 21 side, and gave elasticity. The plating side is turned for the substrate 21 to be plated down, adsorption maintenance of the rear face is carried out by the robot hand 30, and the substrate moved to the inside through the slit shape substrate in-and-out opening 26 of the board holding case 24 to be plated contacts the above-mentioned sealing member 23 and the cathode electrode pin 29.

[0027]The board holder 22 is supported by the axis of rotation 25, and moves between an upper position and lower positions up and down with a slide drive mechanism (not shown). And in an

upper position, the substrate 21 held at the board holding case 24 and the inside to be plated is going up to the position which cannot touch plating liquid, takes out the plated substrate 21 to be plated in this position, and carries the unsettled substrate 21 to be plated in the inside of the board holding case 24. When the board holder 22 is in a lower position, the plating side of the substrate 21 to be plated is immersed in plating liquid.

[0028]As extraction of a substrate to be plated raises the board holder 22 to the above-mentioned upper position which cannot touch plating liquid and it is shown in drawing 6. After raising the substrate-presser-foot board 27, the robot hand 30 is inserted from the substrate in-and-out opening 26 of the board holding case 24, vacuum absorption of the rear face of the substrate 21 to be plated is carried out, it is raised, the slit shape portion 26a of the substrate in-and-out opening 26 is passed, and the substrate 21 to be plated is taken out. For this reason, the opening of the center section 26b of the substrate in-and-out opening 26 is greatly carried out so that the robot hand 30 may pass.

[0029]For making the substrate 21 to be plated insert into the board holding case 24, and making it hold, it carries out in operation contrary to extraction of the above-mentioned substrate 21 to be plated. in this case, the substrate 21 to be plated is arranged within the board holding case 24 at a position — as — the lower inside diameter of the board holding case 24 — the outer diameter of the substrate 21 to be plated — abbreviated — it is the same and enlarges a little.

[0030]In jet plating which plates while carrying out the jet of the plating liquid from the lower part of the plating tub 11, the plating side of the substrate 21 to be plated is turned down, and the substrate 21 to be plated has a common method of contacting a plating side on the plating oil level which was located above the upper bed of the plating tub 11, and rose by the jet. however, an embodiment of the invention — in an example, since the board holder 22 which does not make plating liquid Q_1 contact except the plating side of the substrate 21 to be plated by the sealing member 23 is used, It can plate by making the substrate 21 made to hold to the board holder 22 and this board holder 22 to be plated immersed in plating liquid Q_1 .

[0031]Thereby, the distance of the plating side of the substrate 21 to be plated and the positive electrode plate 19 can be adjusted freely. It is also possible to move to the exterior of the plating tub 11, while the substrate 21 to be plated had been made to hold to the board holder 22, and to carry out backwashing by water of the substrate 21 to be plated and the board holder 22.

[0032]It is effective to rotate the substrate 21 to be plated within the plating tub 11 in order to raise the homogeneity of plating, since neither the flow of plating liquid Q_1 of plating tub 11 inside nor the electric field between the plating sides of the positive electrode plate 19 and the substrate 21 to be plated necessarily becomes uniform at a circumferencial direction. For this reason, the rotary drive (not shown) made to rotate the axis of rotation 25 attached to the board holding case 24 of the board holder 22 is formed. This rotation After equipping the board holder 22 not only with the time of plating but with the substrate 21 to be plated, After raising the board holder 22 and the substrate 21 to be plated on a plating oil level after the cellular removal at the time of making plating liquid Q_1 contact, and the end of electrolysis plating, it is effective also in the plating liquid end by making it rotate.

[0033]The purpose of increasing the plating side of not only rotation but the substrate 21 to be plated and the relative velocity of plating liquid Q_1 , are making thin the concentration diffusion layer near the plating side of the substrate 21 to be plated, and the thing for which plating speed is restricted by the ion amount of supply by making it thin and to say is prevented — the whole surface — a uniform plating tunic is formed, and also current density becomes large and high-speed plating is attained.

[0034]In order to rotate the substrate 21 to be plated, the upper part of the axis of rotation 25

prolonged above the board holder 22 is connected with rotary drives, such as a motor, and it enables it to rotate the substrate 21 to be plated in the level surface in the plating device of composition of being shown in drawing 2. Although the rotation under plating is a 10-300-rpm low speed rotary, the end back substrate holding fixture 22 of plating and the substrate 21 to be plated make it go up to the position which does not contact plating liquid Q_1 , and rotation (desirably rotation of not less than 1000 rpm) of not less than 500 rpm is needed for performing the plating liquid end. For this reason, the control mechanism suitable for this is required for a rotary drive.

[0035]In the plating device of composition of being shown in drawing 2, the pressure plate slide drive mechanism (neither is illustrated) for rise and fall of the holding fixture slide drive mechanism for rise and fall of the board holder 22 and the substrate-presser-foot board 27 was formed in addition to the above-mentioned rotation. It is an air cylinder which drives a pressure plate slide drive mechanism according to spring force downward, and drives it by exhaust air upward, and it is accommodated within the limit supported with the rotary drive, and an air pipe penetrates the center of a motor and is connected outside by the rotary joint in the motor upper part. A motor and pressure plate drive mechanism are accommodated within the limit supported with the holding fixture slide drive mechanism, and go up and down with a holding fixture slide drive mechanism.

[0036]Starting injection of plating liquid Q_1 from the plating liquid jet pipe 13 in [after equipping the board holder 22 with the substrate 21 to be plated] the plating tub 11, and rotating the board holder 22 at 50-300 rpm. The board holder 22 is dropped until the substrate 21 to be plated contacts the plating oil level on which the center rose, and the board holder 22 is dropped further slowly from the state where the center of a plating oil level contacted the substrate 21 to be plated. By carrying out like this, the undersurface of the substrate 21 to be plated is filled up with plating liquid Q_1 , and air is discharged from the space of the substrate 21 to be plated and the lower part of the board holding case 24 of the board holder 22.

[0037]In order to discharge this air efficiently, as shown in drawing 7, two or more vents 31 penetrated outside from the inside of a portion located below the undersurface of the substrate 21 of the peripheral part which is pressing down the substrate 21 to be plated in the lower part of the board holding case 24 to be plated are provided. The height of the air pocket made by this in the lower end peripheral part of the board holding case 24 of the board holder 22 and the crevice formed by the substrate 21 to be plated when a substrate to be plated is put into the plating tub 11, Even if it is after being installed in the position with which the height from the undersurface of the substrate 21 to be plated to the opening upper bed of the vent 31 decreases, and the board holder 22 plates, Air can be easily discharged from the space formed by rotation of the board holder 22 by the substrate 21 to be plated and the lower part of the board holding case 24.

[0038]Drawing 8 is a figure showing other examples of arrangement of the above-mentioned vent 31 which discharges air from the space of the substrate 21 to be plated and the lower part of the board holding case 24. The vent 31 is penetrated on the outside of the portion located above the substrate 21 to be plated from the inside of a portion located below the undersurface of the substrate 21 of the board holding case 24 to be plated so that it may illustrate. It is made for the position, as for, this vent 31 carries out an opening outside to turn into a position above the plating oil level in the plating tub 11 when plating. Thus, when the vent 31 carries out an opening on the outside of the board holding case 24 above a plating oil level, air can be easily discharged from the space formed of the substrate 21 to be plated and the lower part of the board holding case 24. As long as the opening of the above-mentioned vent 31 is above a plating oil level, the opening of it may be carried out to the upper surface or the inner surface of the board holding case 24.

[0039] Drawing 9 is a figure showing other examples of arrangement of the above-mentioned vent 31 which discharges air from the space of the substrate 21 to be plated and the lower part of the board holding case 24. The vent 31 is penetrated to the peripheral part at the bottom from the inside of a portion located below the undersurface of the substrate 21 of the board holding case 24 to be plated so that it may illustrate. Like the plating device of composition of that by arranging the vent 31 as mentioned above shows to drawing 10, When the bigger divider plate 32 than the plating side of the substrate 21 to be plated is formed directly under the peripheral part of the board holder 22, Since the rate of flow of plating liquid Q_1 goes up with the peripheral part down side of the board holder 22 and a static pressure falls, the air caught on the undersurface of the substrate 21 to be plated can be made to discharge outside using the fall of this static pressure.

[0040] When plating, it carries out by letting the wiring 34 and the cathode electrode pin 29 pass from the plating power supply 33, and impressing predetermined voltage between the positive electrode plate 19 and the substrate 21 to be plated.

[0041] the above — an embodiment of the invention, although the example explained the example which uses a semiconductor wafer for the substrate 21 to be plated, The substrate 21 made into the object of plating with the plating device of this invention to be plated is not what is limited to a semiconductor wafer, Naturally it can use for performing metal plating with which this slot, a hole, etc. of the substrate with which a detailed slot, a hole, etc. were formed in the surface are filled up widely, and can use also for surface plating of the substrate with which a detailed slot, a hole, etc. are not formed in the surface.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a figure showing the composition of the jet plating device of the conventional facedown method.

[Drawing 2]It is a figure showing the example of composition of the plating device concerning this invention.

[Drawing 3]It is a figure showing the example of composition of the plating device concerning this invention.

[Drawing 4]It is a figure showing the example of composition of the plating device concerning this invention.

[Drawing 5]It is a figure showing the composition of the board holder of the plating device concerning this invention.

[Drawing 6]It is a figure for explaining operation of the board holder of the plating device concerning this invention.

[Drawing 7]It is a figure showing the example of arrangement of the vent of the board holder lower part of the plating device concerning this invention.

[Drawing 8]It is a figure showing the example of arrangement of the vent of the board holder lower part of the plating device concerning this invention.

[Drawing 9]It is a figure showing the example of arrangement of the vent of the board holder lower part of the plating device concerning this invention.

[Drawing 10]It is a figure showing the example of composition of the plating device concerning this invention.

[Description of Notations]

10 Plating device

11 Plating tub

12 Discharge hole

13 Plating liquid jet pipe

14 Plating liquid depot

15 Pump

16 Filter

17 Plating liquid receiving chute

18 A filter or a separator

19 Positive electrode plate

20 Flow control valve

21 A substrate to be plated

22 Board holder

23 Sealing member

24 Board holding case

- 25 Axis of rotation
- 26 Substrate in-and-out opening
- 27 Substrate-presser-foot board
- 28 Moving shaft
- 29 Cathode electrode pin
- 30 Robot hand
- 31 Vent
- 32 Divider plate

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention]This invention relates to a suitable plating device to perform metal plating with which this slot, a hole, etc. are filled up to the substrate with which a detailed slot, a hole, etc. for wiring were formed especially in the surfaces, such as a semiconductor wafer, to be plated about the plating device which plates a substrate to be plated.

[0002]

[Description of the Prior Art]In recent years, in order to fill this slot, a hole, etc. of a substrate to be plated where the detailed slot and hole for wiring were formed in the surfaces, such as a semiconductor wafer, metal plating devices, such as copper plating, are used and the technique of filling this slot, a hole, etc. by metal plating is adopted. Conventionally, there is a jet plating device of a facedown method as this kind of a plating device. Drawing 1 is a figure showing the composition of the jet plating device of this facedown method.

[0003]The jet plating device 100 of a facedown method, As shown in drawing 1, provide the plating tub 101, and the board holder 103 which makes the substrates 102, such as a semiconductor wafer, to be plated the upper part of this plating tub 101, places the plating side upside down, and is held is provided, With the pump 105, let the filter 106 and the plating liquid feed pipe 107 pass, plating liquid Q_1 in the plating liquid depot 104 was made to blow off from the pars basilaris ossis occipitalis of the plating tub 101, and the jet of plating liquid is applied at right angles to the plating side of the substrate 102 to be plated.

[0004]Plating liquid Q_1 which overflowed the plating tub 101 is collected in the plating liquid receiving chute 108 arranged at the outside of the plating tub 101, and returns to the plating liquid depot 104. From the plating power supply 109, by impressing predetermined voltage between the anode electrode 110 and a cathode electrode (plating side of the substrate 102 to be plated), a plating current flows between this anode electrode 110 and the plating side of the substrate 102 to be plated, and a plating film is formed in the plating side of the substrate 102 to be plated.

[0005]Conventionally [above-mentioned] the jet plating device 100 of the facedown method of composition, A holding pin and cathode pins are provided in the board holder 103 arranged in the upper part of the plating tub 101, Turned the substrate 102 to be plated downward, held the plating side for it, plating liquid Q_1 was made to flow out of the upper bed of the plating tub 101, and the crevice between the substrates 102 to be plated, and it has plated to the substrate 102 to be plated.

[0006]However, if the cathode pins for supplying electric power to the plating side of the substrate 102 to be plated touch plating liquid Q_1 , when plating metal will deposit also in a cathode-pins part and they will take out a substrate to be plated, they have the danger of

destroying the plating membrane layer near the cathode pins. Since it is easy to diffuse copper in silicon when carrying out electrolysis plating of the copper plating to the substrate 102 to be plated being a semiconductor wafer in the plating side of this semiconductor wafer, Although electrolysis plating is performed by using as the negative pole the copper layer which formed TiN, TaN, etc. as a barrier layer to the plating side of the semiconductor wafer, and was thinly formed this barrier layer or on it, Since the barrier layer is not formed in the rear face or the side of a semiconductor wafer, the plating liquid containing copper must be prevented from adhering to this portion.

[0007]For this reason, by immersion plating which plating liquid is made to immerse, a substrate to be plated. The semiconductor wafer which is the substrate 102 to be plated is held with the board holder 103, Carry out the seal of the peripheral part of the surface of a semiconductor wafer by a sealing member, and the peripheral part and rear face of a semiconductor wafer are made not to be soaked in plating liquid, In the space which cannot touch the board holder 103, a semiconductor wafer, and the plating liquid formed by the sealing member, the semiconductor wafer rear face is contacted to cathode pins.

[0008]Since the circumference of the board holder 103 protrudes below the plating side of the substrate 102 to be plated when using the above board holders 103 for the jet plating device of a facedown method, Only by contacting the substrate held at the board holder 103 to be plated on a plating oil level, the air layer was made on the semiconductor wafer surface, and there was a problem that a normal plating film could not be formed.

[0009]

[Problem(s) to be Solved by the Invention]This invention was made in view of the above-mentioned point, and is a jet plating device of a facedown method. The purpose is to provide the plating device which can form a quality plating film by there being no metallic contamination of the rear face of a substrate to be plated or the side, and not leaving air bubbles to a plating side, without moreover forming a plating film in cathode pins.

[0010]

[Means for Solving the Problem]In order to solve an aforementioned problem the invention according to claim 1, It has a sealing member of ring shape which contacts a plating side periphery which plates a substrate to be plated, Expose a plating side of this substrate to be plated, and a board holder which turns this plating side downward and holds it is provided, In a plating device which plates while generating a plating liquid jet which reaches a plating side of this substrate to be plated from a lower part of a substrate held at a board holder within a plating tub with which plating liquid was filled to be plated, A vent which misses air bubbles which remain to a plating side of a substrate to be plated at a lower end part of a board holder on the outside of this board holder was provided.

[0011]As for a portion located below a substrate of a peripheral part of a board holder to be plated, in order to lessen air bubbles which remain in a plating side of a substrate to be plated, it is desirable to make it as thin as possible, but. In order to stick a substrate to be plated and a sealing member and to stick a substrate to be plated and cathode pins, In order to stop with a pressure plate from a rear face of a substrate to be plated and to receive this pressing-down power, it is difficult to decrease a portion located below a plating side of a substrate of a peripheral part of a board holder to be plated to several millimeters or less. For this reason, it escapes from air bubbles which remain to space surrounded in respect of plating of a lower peripheral part of a board holder, and a substrate to be plated outside through this vent by providing a vent in this portion as mentioned above.

[0012]However, since a sealing member and cathode pins are among portions located below a plating side of a substrate of a peripheral part of a board holder to be plated, a vent cannot be provided in the same height as a plating side of a substrate to be plated. Therefore, since remains

air bubbles of a plating side of a substrate to be plated cannot be removed thoroughly, by rotating a board holder and a wafer, a flow which goes outside from the center of a substrate to be plated can be strengthened, and air bubbles which remain to a plating side of a substrate to be plated by this flow can be poured.

[0013]The invention according to claim 2 is characterized by a vent being a hole penetrated to a peripheral face from inner skin of a portion located below a plating side of a substrate of a board holder to be plated in the plating device according to claim 1.

[0014]The invention according to claim 3 is characterized by a vent being a hole penetrated to a peripheral face or inner skin of a portion located above plating liquid in a plating tub from inner skin of a portion located below a plating side of a substrate of a board holder to be plated in the plating device according to claim 1.

[0015]As mentioned above, it becomes easy to escape by using a vent as a hole penetrated to a peripheral face or inner skin of a portion located above a plating oil level from inner skin of a portion located below a plating side of a substrate to be plated from air bubbles which remain to a plating side of a substrate to be plated through this vent.

[0016]The invention according to claim 4 is characterized by a vent being a hole penetrated to a peripheral part at the bottom from inner skin of a portion located below a plating side of a substrate of a board holder to be plated in the plating device according to claim 1.

[0017]As mentioned above, by using a vent as a hole penetrated to a peripheral part at the bottom from inner skin of a portion located below a plating side of a substrate of a board holder to be plated, When [when the rate of flow of the board holder bottom is large] a static pressure is low, it escapes from air bubbles which remain to a plating side of a substrate to be plated according to a static pressure difference inside an undersurface peripheral part of a board holder through this vent.

[0018]

[Embodiment of the Invention]the following and an embodiment of the invention — an example is explained based on a drawing. Drawing 2 is a figure showing the example of composition of the plating device concerning this invention. This plating device 10 possesses the plating tub 11. This plating tub 11 is a cylindrical shape section, the pars basilaris ossis occipitalis is tapered shape with a low center, and the discharge hole 12 for making plating liquid Q_1 flow into the circumference of the lowest center point to the exterior of the plating tub 11 is formed. The plating liquid jet pipe 13 which turns plating liquid Q_1 to the center section of the plating tub 11 up, and is spouted has projected even inside the plating tub 11.

[0019]With the pump 15, plating liquid Q_1 injected from the plating liquid jet pipe 13 through the filter 16 from the plating liquid depot 14, It overflows from the rising wood of the plating tub 11, is collected in the plating liquid receiving chute 17 established in the outside of the plating tub 11, and flows into the plating liquid depot 14 from this plating liquid receiving chute 17. A part of plating liquid Q_1 which blew off from the plating liquid jet pipe 13. After it flows into the exterior of the plating tub 11 through the discharge hole 12 and a filter or the separator 18 removes the affix to the peeling piece and the positive electrode plate 19 of a black film, and a sediment, it flows into the plating liquid depot 14. Although it is made to flow down with the gravity of plating liquid Q_1 between the plating liquid depots 14 from the discharge hole 12 in drawing 2, a pump may be formed between a filter or the separator 18 from the discharge hole 12. 20 is a flow control valve.

[0020]The positive electrode plate 19 is allocated in the lower part in plating liquid Q_1 of the plating tub 11 right-angled at the medial axis of this plating tub 11. In the case of copper plating, phosphorus-containing copper is used at this positive electrode plate 19 using a soluble electrode plate. Although an opening is formed in the center by disc-like, the positive electrode plate 19

arranges the plating liquid jet pipe 13 through the inside of an opening and the plating liquid flow which flows through the circumference of this positive electrode plate 19 is passed to the exterior of the plating tub 11 through the discharge hole 12 which has this positive electrode plate 19 caudad in drawing 2. Two or more breakthroughs may be provided in the positive electrode plate 19, and plating liquid Q_1 which passed along this breakthrough may be made to flow out of the discharge hole 12 into the exterior of the plating tub 11, as shown in drawing 3. The plating liquid jet pipe 13 is making plating liquid blow off from the lower peripheral part of the plating tub 11 towards an upper center with the plating device of drawing 3.

[0021]As shown in drawing 4, it is also possible to make the plating liquid which penetrated the positive electrode plate 19 flow out of a collective part into the exterior of the plating tub 11 through the discharge hole 12. the positive electrode plate 19 — the plating side of the substrate 21 to be plated — abbreviated — it being considered as the flat surface which countered the substrate 21 to be plated, if there is a size of the same grade, but. It is good to consider it as sphere form, as the positive electrode plate 19 shows drawing 3 substantially small, when the plating side of the substrate 21 to be plated and the interval of the positive electrode plate 19 are small compared with the plating side of the substrate 21 to be plated.

[0022]When the substrate 21 to be plated is a semiconductor wafer, the board holder 22 holding the substrate 21 to be plated is explained based on drawing 5 and drawing 6. Since it is easy to diffuse copper into silicon as mentioned above when carrying out electrolysis plating of the copper on the surface of a semiconductor wafer, Electrolysis plating is performed by using as the negative pole the copper layer which formed metal, such as Ti, Ta, TiN, and TaN, or the compound of those to the plating side of the semiconductor wafer, and was thinly formed as a barrier layer in it at this barrier layer or an it top.

[0023]If the cathode electrode pin 29 for supplying electric power to the plating side of the substrate 21 to be plated touches plating liquid Q_1 , when plating metal will deposit also in this cathode electrode pin 29 and it will pick out the substrate 21 to be plated from the board holder 22, its danger of destroying the plating film near the cathode electrode pin 29 is high. Therefore, the substrate 21 to be plated is made to hold to the board holder 22, as shown in drawing 5. A seal is carried out by the sealing member 23 so that plating liquid Q_1 may not infiltrate into the surface peripheral part of the substrate 21 to be plated, In the space which cannot touch plating liquid Q_1 formed by the board holder 22, the substrate 21 to be plated, and the sealing member 23, the cathode electrode pin 29 is contacted on the surface of the substrate 21 to be plated.

[0024]The board holder 22 possesses the board holding case 24 which can accommodate the substrate 21 to be plated in an inside. This board holding case 24 is the cylindrical shape of a little larger path than the path of a substrate to be plated, the opening of the path in which the lower end surface is a little smaller than the substrate 21 to be plated is formed, and an upper bed side is the closed structure. And the axis of rotation 25 is attached in the center of the upper surface of this board holding case 24, and the slit shape substrate in-and-out opening 26 for taking the substrate 21 to be plated in and out is formed in the side. moreover — the board holding case 24 consists of insulation materials — the inside — the path of the substrate 21 to be plated — abbreviated — the disc-like substrate-presser-foot board 27 of the same path is provided.

[0025]The substrate-presser-foot board 27 consists of insulation materials, and the moving shaft 28 which moves this substrate-presser-foot board 27 up and down is attached in the center of the upper surface. This moving shaft 28 penetrated the center section of the axis of rotation 25 attached to the upper surface of the board holding case 24, and is extended up. Around the opening of the undersurface of the board holding case 24, The sealing member 23 of ring shape is formed, plating liquid permeates into the board holding case 24, and this sealing member 23 is prevented from touching plating liquid by sticking to the surface (undersurface) of the substrate

21 to be plated in the rear face and peripheral face of the substrate 21 to be plated. It is the outside of this sealing member 23, and plurality of the cathode electrode pin 29 of ring shape is formed inside [undersurface] the board holding case 24, and this cathode electrode pin 29 contacts the surface peripheral part of the substrate 21 to be plated.

[0026]In order to make uniform potential of the plating side of the substrate 21 to be plated, As for the cathode electrode pin 29, it is preferred to consider it as the structure which consisted of ring shape boards so that it might contact throughout the surface periphery of the substrate 21 to be plated, and line contact of the pin might be carried out to the shape of the substrate 21 to be plated put in order densely, bent the inner periphery to the substrate [to be plated] 21 side, and gave elasticity. The plating side is turned for the substrate 21 to be plated down, adsorption maintenance of the rear face is carried out by the robot hand 30, and the substrate moved to the inside through the slit shape substrate in-and-out opening 26 of the board holding case 24 to be plated contacts the above-mentioned sealing member 23 and the cathode electrode pin 29.

[0027]The board holder 22 is supported by the axis of rotation 25, and moves between an upper position and lower positions up and down with a slide drive mechanism (not shown). And in an upper position, the substrate 21 held at the board holding case 24 and the inside to be plated is going up to the position which cannot touch plating liquid, takes out the plated substrate 21 to be plated in this position, and carries the unsettled substrate 21 to be plated in the inside of the board holding case 24. When the board holder 22 is in a lower position, the plating side of the substrate 21 to be plated is immersed in plating liquid.

[0028]As extraction of a substrate to be plated raises the board holder 22 to the above-mentioned upper position which cannot touch plating liquid and it is shown in drawing 6, After raising the substrate-presser-foot board 27, the robot hand 30 is inserted from the substrate in-and-out opening 26 of the board holding case 24, vacuum absorption of the rear face of the substrate 21 to be plated is carried out, it is raised, the slit shape portion 26a of the substrate in-and-out opening 26 is passed, and the substrate 21 to be plated is taken out. For this reason, the opening of the center section 26b of the substrate in-and-out opening 26 is greatly carried out so that the robot hand 30 may pass.

[0029]For making the substrate 21 to be plated insert into the board holding case 24, and making it hold, it carries out in operation contrary to extraction of the above-mentioned substrate 21 to be plated. in this case, the substrate 21 to be plated is arranged within the board holding case 24 at a position — as — the lower inside diameter of the board holding case 24 — the outer diameter of the substrate 21 to be plated — abbreviated — it is the same and enlarges a little.

[0030]In jet plating which plates while carrying out the jet of the plating liquid from the lower part of the plating tub 11, the plating side of the substrate 21 to be plated is turned down, and the substrate 21 to be plated has a common method of contacting a plating side on the plating oil level which was located above the upper bed of the plating tub 11, and rose by the jet. however, an embodiment of the invention — in an example, since the board holder 22 which does not make plating liquid Q_1 contact except the plating side of the substrate 21 to be plated by the sealing member 23 is used, It can plate by making the substrate 21 made to hold to the board holder 22 and this board holder 22 to be plated immersed in plating liquid Q_1 .

[0031]Thereby, the distance of the plating side of the substrate 21 to be plated and the positive electrode plate 19 can be adjusted freely. It is also possible to move to the exterior of the plating tub 11, while the substrate 21 to be plated had been made to hold to the board holder 22, and to carry out backwashing by water of the substrate 21 to be plated and the board holder 22.

[0032]It is effective to rotate the substrate 21 to be plated within the plating tub 11 in order to raise the homogeneity of plating, since neither the flow of plating liquid Q_1 of plating tub 11 inside nor the electric field between the plating sides of the positive electrode plate 19 and the

substrate 21 to be plated necessarily becomes uniform at a circumferential direction. For this reason, the rotary drive (not shown) made to rotate the axis of rotation 25 attached to the board holding case 24 of the board holder 22 is formed. This rotation After equipping the board holder 22 not only with the time of plating but with the substrate 21 to be plated, After raising the board holder 22 and the substrate 21 to be plated on a plating oil level after the cellular removal at the time of making plating liquid Q_1 contact, and the end of electrolysis plating, it is effective also in the plating liquid end by making it rotate.

[0033]The purpose of increasing the plating side of not only rotation but the substrate 21 to be plated and the relative velocity of plating liquid Q_1 , are making thin the concentration diffusion layer near the plating side of the substrate 21 to be plated, and the thing for which plating speed is restricted by the ion amount of supply by making it thin and to say is prevented — the whole surface — a uniform plating tunic is formed, and also current density becomes large and high-speed plating is attained.

[0034]In order to rotate the substrate 21 to be plated, the upper part of the axis of rotation 25 prolonged above the board holder 22 is connected with rotary drives, such as a motor, and it enables it to rotate the substrate 21 to be plated in the level surface in the plating device of composition of being shown in drawing 2. Although the rotation under plating is a 10-300-rpm low speed rotary, the end back substrate holding fixture 22 of plating and the substrate 21 to be plated make it go up to the position which does not contact plating liquid Q_1 , and rotation (desirably rotation of not less than 1000 rpm) of not less than 500 rpm is needed for performing the plating liquid end. For this reason, the control mechanism suitable for this is required for a rotary drive.

[0035]In the plating device of composition of being shown in drawing 2, the pressure plate slide drive mechanism (neither is illustrated) for rise and fall of the holding fixture slide drive mechanism for rise and fall of the board holder 22 and the substrate-presser-foot board 27 was formed in addition to the above-mentioned rotation. It is an air cylinder which drives a pressure plate slide drive mechanism according to spring force downward, and drives it by exhaust air upward, and it is accommodated within the limit supported with the rotary drive, and an air pipe penetrates the center of a motor and is connected outside by the rotary joint in the motor upper part. A motor and pressure plate drive mechanism are accommodated within the limit supported with the holding fixture slide drive mechanism, and go up and down with a holding fixture slide drive mechanism.

[0036]Starting injection of plating liquid Q_1 from the plating liquid jet pipe 13 in [after equipping the board holder 22 with the substrate 21 to be plated] the plating tub 11, and rotating the board holder 22 at 50-300 rpm. The board holder 22 is dropped until the substrate 21 to be plated contacts the plating oil level on which the center rose, and the board holder 22 is dropped further slowly from the state where the center of a plating oil level contacted the substrate 21 to be plated. By carrying out like this, the undersurface of the substrate 21 to be plated is filled up with plating liquid Q_1 , and air is discharged from the space of the substrate 21 to be plated and the lower part of the board holding case 24 of the board holder 22.

[0037]In order to discharge this air efficiently, as shown in drawing 7, two or more vents 31 penetrated outside from the inside of a portion located below the undersurface of the substrate 21 of the peripheral part which is pressing down the substrate 21 to be plated in the lower part of the board holding case 24 to be plated are provided. The height of the air pocket made by this in the lower end peripheral part of the board holding case 24 of the board holder 22 and the crevice formed by the substrate 21 to be plated when a substrate to be plated is put into the plating tub 11, Even if it is after being installed in the position with which the height from the undersurface of the substrate 21 to be plated to the opening upper bed of the vent 31 decreases,

and the board holder 22 plates, Air can be easily discharged from the space formed by rotation of the board holder 22 by the substrate 21 to be plated and the lower part of the board holding case 24.

[0038] Drawing 8 is a figure showing other examples of arrangement of the above-mentioned vent 31 which discharges air from the space of the substrate 21 to be plated and the lower part of the board holding case 24. The vent 31 is penetrated on the outside of the portion located above the substrate 21 to be plated from the inside of a portion located below the undersurface of the substrate 21 of the board holding case 24 to be plated so that it may illustrate. It is made for the position, as for, this vent 31 carries out an opening outside to turn into a position above the plating oil level in the plating tub 11 when plating. Thus, when the vent 31 carries out an opening on the outside of the board holding case 24 above a plating oil level, air can be easily discharged from the space formed of the substrate 21 to be plated and the lower part of the board holding case 24. As long as the opening of the above-mentioned vent 31 is above a plating oil level, the opening of it may be carried out to the upper surface or the inner surface of the board holding case 24.

[0039] Drawing 9 is a figure showing other examples of arrangement of the above-mentioned vent 31 which discharges air from the space of the substrate 21 to be plated and the lower part of the board holding case 24. The vent 31 is penetrated to the peripheral part at the bottom from the inside of a portion located below the undersurface of the substrate 21 of the board holding case 24 to be plated so that it may illustrate. Like the plating device of composition of that by arranging the vent 31 as mentioned above shows to drawing 10, When the bigger divider plate 32 than the plating side of the substrate 21 to be plated is formed directly under the peripheral part of the board holder 22, Since the rate of flow of plating liquid Q_1 goes up with the peripheral part down side of the board holder 22 and a static pressure falls, the air caught on the undersurface of the substrate 21 to be plated can be made to discharge outside using the fall of this static pressure.

[0040] When plating, it carries out by letting the wiring 34 and the cathode electrode pin 29 pass from the plating power supply 33, and impressing predetermined voltage between the positive electrode plate 19 and the substrate 21 to be plated.

[0041] the above — an embodiment of the invention, although the example explained the example which uses a semiconductor wafer for the substrate 21 to be plated, The substrate 21 made into the object of plating with the plating device of this invention to be plated is not what is limited to a semiconductor wafer, Naturally it can use for performing metal plating with which this slot, a hole, etc. of the substrate with which a detailed slot, a hole, etc. were formed in the surface are filled up widely, and can use also for surface plating of the substrate with which a detailed slot, a hole, etc. are not formed in the surface.

[0042]

[Effect of the Invention] As explained above, according to the invention given in each claim, so that plating liquid cannot be touched other than the plating side of a substrate to be plated, In the plating device which plates while generating the plating liquid jet which carries out a seal by a sealing member and reaches a plating side from a lower part, Since the vent which misses the air bubbles which remain to the plating side of a substrate to be plated at the lower end part of a board holder on the outside of a board holder was provided, Without forming a plating film in cathode pins, when there is no metallic contamination of the rear face of a substrate to be plated or the side and air bubbles do not remain in a plating side, the outstanding effect that the plating device which is excellent in the homogeneity of a plating film and does not have silverfish and which can perform quality plating can be provided is acquired.

[0043] In [according to the invention according to claim 3] the plating device according to claim 1, Since a vent is used as the hole penetrated to the peripheral face or inner skin of a portion located above the plating liquid in a plating tub from the inner skin of the portion located below

the plating side of the substrate of a board holder to be plated, it becomes easy to escape from the air bubbles which remain to the plating side of a substrate to be plated in addition to the above-mentioned effect through this vent.

[0044] Since a vent is used as the hole penetrated to a peripheral part at the bottom from the inner skin of the portion located below the plating side of the substrate of a board holder to be plated in the plating device according to claim 1 according to the invention according to claim 4, in addition to the above-mentioned effect, when [when the rate of flow of the board holder bottom is large] a static pressure is low, it escapes from the air bubbles which remain to the plating side of a substrate to be plated according to the static pressure difference inside the undersurface peripheral part of a board holder through this vent.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.** shows the word which can not be translated.**

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]A plating device comprising:

A board holder which has a sealing member of ring shape which contacts a plating side periphery which plates a substrate to be plated, is made to expose a plating side of this substrate to be plated, and turns this plating side downward and holds it.

In a plating device which plates while generating a plating liquid jet which reaches a plating side of this substrate to be plated from a lower part of a substrate held at said board holder within a plating tub with which plating liquid was filled to be plated, A vent which misses air bubbles which remain to a plating side of a substrate to be plated at a lower end part of said board holder on the outside of this board holder.

[Claim 2]A plating device characterized by said vent being a hole penetrated to a peripheral face from inner skin of a portion located below a plating side of a substrate of said board holder to be plated in the plating device according to claim 1.

[Claim 3]A plating device characterized by said vent being a hole penetrated to a peripheral face or inner skin of a portion located above plating liquid in said plating tub from inner skin of a portion located below a plating side of a substrate of said board holder to be plated in the plating device according to claim 1.

[Claim 4]A plating device characterized by said vent being a hole penetrated to a peripheral part at the bottom from inner skin of a portion located below a plating side of a substrate of said board holder to be plated in the plating device according to claim 1.

[Translation done.]